REMARKS

As an initial matter, the Applicant wishes to thank the Examiner for pointing out that a clerical error existed in paragraph 4, page 1 of the application. The Applicant has reviewed and corrected paragraphs 3, 4, 5, 6, and 9, accordingly. Applicant has also added claims 5-10. Support for new claims 5, 7, and the applicable portion of claims 6 and 10 is found in paragraph 4 of the application. The Applicant submits that these minor amendments and corrections herein are made without prejudice as to patentability, including the doctrine of equivalents, and no new matter has been added.

Claims 1-4 (and new claims 5-10) are Not Obvious.

The Examiner rejected Claims 1-4 under 35 U.S.C. 103(a) as being "unpatentable over applicants' recitation of the prior art (Background of the Invention, paragraphs 3-6) when taken with Yuratich et al. (U.S. Patent No. 6,653,839). Applicant respectfully traverses the rejection.

Yuratich describes a measurement apparatus and method for determining the electrical resistivity or resistance of rocks surrounding a drill hole 2 as an indicator of the structure of a rock which can be utilized to determine the likely presence of oil bearing strata. More specifically, referring to Figure 1 and col. 2, lines 9-36, Yuratich describes an electrical circuit having a generator 10 which supplies to a rock formation 4 alternating voltage having a frequency range of between 5 and 20 kHz. The generator 10 is connected to a remote electrode 12 with one terminal and connected to a sensor element 6 and guard element 8 with the opposite terminal. The electrode 12, sensor element 6, and guard element 8 are each in contact with formation 4 to be measured. In order to obtain an accurate measurement, the current flowing through an imaginary cylinder 14 (illustrated in Fig. 1) adjacent sensor element 6 must be substantially linear and uniform. To achieve this, the Yuratich measurement apparatus includes a circuit having a detector portion 20 (Fig. 2) designed to maintain the voltage at the guard element 8 at the same voltage as sensor element 6. Referring to Figure 2, the detector

portion 20 is connected between the generator 10 and the sensor element 6 within line 16 to detect the current flowing through line 16 which corresponds with current flowing through the adjacent rock strata surrounding hole 2 (Figure 1) being examined. The detector portion 20 includes an operational amplifier 22 which functions to both match the voltage of the sensor element 6 with that of the guard element 8 connected and to detect the current in line 16. The operational amplifier 22 includes a resistor 30 positioned within a feedback loop of the operational amplifier 22. The voltage drop across the resistor 30 is proportional to the current flowing through the line 16.

Referring to Figure 5, a calculation portion 48 of the apparatus includes a differential amplifier 50 which produces an output corresponding to the voltage drop across resistor 30. *See also*, col. 7, lines 32-53. A rectifier 56 converts the incoming (alternating) signal (containing noise) from the differential amplifier 50 into a rectified signal, curve 82 (Fig. 6), containing the same amount of noise. *See also*, col. 8, lines 39-57. A pair of integrators 66a and 66b alternate determining the area under the curve 82 for a corresponding alternating pair of time blocks or periods, shown in Figure 6 as 2/3 of a millisecond or five cycles of curve 82 which relate to five cycles of the voltage applied to the rock strata by generator 10. Referring to integrator 66a, when switches 72a and 76a are closed, curve 82 corresponds to the rectified voltage drop across resistor 30 together with noise (not shown). When the switches are open, the signal reaching the integrator 66a goes to zero and the signal from the rectifier 56 (which corresponds to the signal from a second sensor 6 in a multi-sensor arrangement such as that shown in Fig. 3) passes to integrator 66b.

Referring to Figure 6, the output of the integrator 66a is shown by curve 84 which starts at zero at the beginning of each time period or block and rises in conformity with the amplitude of the signal passing along line 64, then remains unchanged when the input is zero at the completion of the time period or blocks, the value of the signal 90 being dependent upon the area under the curve 82. The output 88a of the integrator (signal 90) is then sampled prior to switch 92a closing and resetting the output 88a (signal 90) to zero prior to the next integration being performed on the signal from the next sensor 6. The output of the integrators 66a, 66b are connected to an analog to digital converter (not

shown) which converts the signal 90 into a digital signal representation of the measured resistance of the rock adjacent a particular sensor element 6 at a particular location. *See* col. 10, lines 42-56.

Yuratich, however, does not disclose: (1) a method of monitoring a microseismic *event*; (2) detecting the microseismic event to produce a first signal dependent on the microseismic event, the first signal including noise at a frequency of f Hz; (3) taking a first and a second sample of the first signal; (4) the second sample occurring n/f seconds after the first sample, where n is an integer; and (5) subtracting the first and second samples from each other to produce a further signal dependent on the microseismic event in which said noise has been at least partly compensated for.

<u>Claims 1-4 (and new claims 5-10) are not obvious over Applicant's recitation of the prior art (Background of the Invention, paragraphs 3-6) when taken with Yuratich et al.</u>

To establish a *prima facie* case of obviousness, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. *See* MPEP 2143. The Applicant respectfully submits that there is no explicit or implicit motivation to modify the reference or combine teachings nor knowledge generally available to one of ordinary skill in the art. Further, applicant respectfully submits that Yuratich et al. is not analogous art because it is not reasonably pertinent to the particular problem with which the Applicant is concerned.

First, the Yuratich et al. invention is not in the field of microseismic detection, but is instead concerned with determining the electrical resistivity/resistance of rock formations. It is highly unlikely that a skilled artisan would consider the document when looking for a solution to the problem of noise produced by cathodic protection currents when making microseismic measurements.

Yuratich et al. describes a problem of determining the resistance of rock strata as an indication of the existence of hydrocarbons using a circuit that would allow current induced within the rock strata to enter a sensor 6 in a substantially perpendicular manner,

i.e. one that would not result in a voltage mismatch between the sensor 6 and an adjacent guard element 8. *See* col. 2, lines 37-57 and col. 4, lines 52-62.

Applicant's problem, noise produced by cathodic protection currents resulting from the production of a DC current derived by rectification of a AC main supply, was motivated by the need to render functional trigger algorithms (seismic triggers), such as those described in Application paragraph 5, that are sensitive to such noise.

Nowhere in Yuratich et al. is there disclosed, taught, or suggested that noise identified in col. 3, lines 36-39 is the result of DC current derived by rectification of an AC source. It is only identified that a certain amount of noise exists in the signal containing information about the current flow in the rock strata and that the prior art has sought to reduce the amount of noise by filtering methods. No prior art methods of filtering, however, are disclosed. Further, if one were to combine Yuratich et al. with the additional patents supplied by the Examiner, at best one would only determine this noise to be ambient electromagnetic energy or electromagnetic energy from some external surface activity, and not noise produced by cathodic protection currents.

Yuratich et al. describes a solution for its main problem along with an apparently incidental noise problem to be accomplished by determining for a preselected time band (illustrated in Fig. 6 as 2/3 of a millisecond) the area under a rectified signal (curve 82) derived from a voltage signal indicating a voltage drop across resistor 30 (Fig. 2) which is proportional to the current flowing through the rock strata adjacent sensor 6 (Fig. 1). *See* col. 5, lines 12-23, and col. 10, lines 29-32. Yuratich et al. discloses that by cumulatively determining the area under curve 82 over multiple cycles of its generator 10 (5 rectified cycles illustrated in Fig. 6), noise is averaged out. *See* col. 9, lines 55-62. Notably, in the illustrated example, which describes Yuratich's preferred embodiment, the Yuratich invention is described as substantially removing all the noise with a period of less than half the integration time (2/3 of a millisecond) which equates to a filtering of noise signals greater than or equal to 3000 Hz. *See* col. 9, lines 55-62, col. 10, lines 29-32. Clearly, noise produced by cathodic protection currents on the order of 50-60 Hz was not contemplated nor addressed.

Thus, the Applicant respectfully submits that Yuratich et al. is not analogous art and does not provide some suggestion or motivation to modify the reference or to combine reference teachings, nor has it been shown that the knowledge generally available to one of ordinary skill in the art would be sufficient to suggest or motivate such combination. Further, even if the references somehow could be combined or modified, this still is not sufficient to establish a *prima facie* obviousness unless the prior art also suggests the desirability of the combination, which it does not. MPEP 2143.01. The level of skill in the art cannot be relied upon to provide the suggestion to combine references. *See* MPEP 2143.01 (*citing Al-Site Corp. v. VSI Int'l Inc.*, 174 F.3d 1308, 50 USPQ2d 1161 (Fed. Cir. 1999)). Even if the claimed invention is within the ordinary skill of the art at the time the claimed invention was made ("college-level education and over three (3) years of experience"), this is not sufficient by itself without some objective reason to combine the teachings of the references. *See* MPEP 2143.01 (*citing Ex parte Levengood*, 28 USPQ2d 1300 (Bd. Pat. App. & Inter. 1993)).

Not only is there no suggestion as to the desirability of the combination, there must be, and there is not a reasonable expectation of success. The output of the integrators 66a, 66b (curve 84) is only a voltage representing the value of the area under curve 82, and not a signal usable by trigger algorithms. *See* col. 9, lines 34-43. Thus, the Yuratich et al. invention would destroy the purpose of the Applicant's invention, and render useless the seismic triggers identified in the Background of the Invention section of the application. The Applicant's invention provides a seismic signal at least partially free of noise to allow the use of existing trigger detection algorithms such that their levels of detection becomes similar to those achieved when no noise is present. *See* Application, paragraph 11. Again, the Yuratich invention does not provide a signal such as the original voltage signal (representing the voltage drop across resistor 30), but instead provides a single value indicating the area under the curve 82 with mid and high-frequency noise averaged out. Thus, the Applicant respectfully submits that there would be no expectation of success in combining the Yuratich invention with prior art referenced in the application.

Finally, and most importantly, to establish a *prima facie* case of obviousness, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination along with the above described reasonable expectation of success must both be found in the prior art and not based on Applicant's disclosure. *See In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438, 1442 (Fed. Cir. 1991). The Examiner has cited the Background of the Invention section of the disclosure, rather than any specific prior art reference, along with Yuratich et al. as forming a basis of the rejection. Nevertheless, even prior art inherently described when combined with Yuratich et al. fall short of disclosing much less teaching or suggesting all of the claim limitations.

Specifically, with respect to each of the independent claims, as described previously, Yuratich et al. does not disclose a method of monitoring a microseismic *event*. Yuratich et al. instead detects a current induced in rock strata in order to determine the resistance and thus the potential presence of oil bearing strata.

Yuratich et al. does not disclose detecting a microseismic event to produce a first signal dependent on the microseismic event, and taking a first and a second sample of the first signal, the second sample occurring n/f seconds after the first sample, where n is an integer and f is the approximate frequency of the *noise*. Nor does the "Background of the Invention" section state that the prior art does so. Yuratich et al. instead continuously detects and analyzes bands of current/voltage signal representing current induced through the rock strata being analyzed. A *single* sample is then taken of the output of the integrators 66a, 66b, and not of the detected current/voltage. Also, as stated previously, Yuratich et al. does not describe the frequency of noise and thus does not disclose selecting a sample time period based on a period 1/f of the expected noise as featured in each independent claims. Nor is such period 1/f based on an integer value n of the period 1/f as featured in claim 1.

Nor does Yuratich et al. disclose subtracting the first and second samples from each other to produce a further signal dependent on the microseismic event in which said noise has been at least partly compensated for. The Yuratich et al. invention determines the area under the "curve" of each band of signal to form a representation of the electrical

resistance of the rock strata being examined. It is only through averaging resulting from an accumulation of the area under the curve 82 formed by the rectified AC voltage drop detected across resistor 30 that the noise signal is reduced, and not through subtraction of one sample having a noise signal from another sample.

More specifically, the noise reduction technique employed by Yuratich does not involve the subtraction of a later signal sample from an earlier signal sample as required by the present invention. Instead, an integrator sums (integrates) a single signal sample over a period (illustrated as 2/3 of a millisecond). *See* Fig. 6. As the noise signal periodically fluctuates, the noise component will tend to cancel itself out in the final integrated signal 90 value. For example, suppose that a constant signal S is measured, which has a sinusoidally varying noise signal N(t) = N cos t superimposed on the signal S. Integrating the total signal from time t1 to t2 (the area under the curve from t1 to t2) gives:

$$\begin{aligned} \text{Area} &= \int S + N \cos t \\ &= St + N \sin t + \text{constant.} \end{aligned}$$

Therefore, the area from time t1 to time t2 = (St2 + N sin t2 + C) - (St1 + N sin t1 + C)

= S(t2 - t1) + N(sin t2 - sin t1).

Yuratich et al. assumes that the period of the noise cycle is smaller (1/2 or less) than the sampling time. In the best case scenario, the sampling time t2 - t1 will be approximately equal to an integral number of noise cycle periods. In this case, the sin t2 = sin t1, and so the noise component will cancel completely. Even if the sampling time is not exactly equal to the noise cycle period, the chances are that the noise component will still be much reduced. This method is explained quite clearly from col. 9, line 55 to col. 10, line 3.

Regarding claims 2-3 and 8-9, nothing is disclosed with respect to having integer multiples or such integer multiples of 50 Hz. Regarding claims 5-6, 7, and 10, nothing is disclosed with respect to the problem of noise produced by cathodic protection currents. Regarding claim 10, nothing is disclosed with respect to rectifying an AC main supply to produce DC current, the DC current containing a noise signal having a base frequency f Hz equivalent to the frequency of the AC main supply and harmonics thereof.

In summary, only one sample is taken and no subtraction occurs. The present invention requires taking first and second samples of a first signal and subtracting the first and second samples from each other to produce a further signal dependent on said event, not disclosed, taught, or suggested by Yuratich et al. Further, Yuratich et al. does not disclose, teach, or suggest taking samples at a period n/f apart, where f is the frequency of the noise. In fact, the frequency of the noise is apparently not determined or otherwise known, the noise frequency value being of little consequence to the method of Yuratich et al. Thus, the Applicant respectfully submits that each and every claim limitations is not disclosed, taught, or suggested. Applicant respectfully requests the Examiner withdraw the rejection of claims 1-4 and allow those claims along with claims 5-10.

CONCLUSION

In view of the amendments and remarks set forth herein, Applicants respectfully submit that the application is in condition for allowance. Accordingly, the issuance of a Notice of Allowance in due course is respectfully requested.

Respectfully submitted,

Date: Sept 15, 2004

James E. Bradley

James E. Bradley
Reg. No. 27,536
Attorney for Applicant

BRACEWELL & PATTERSON, L.L.P.
P.O. Box 61389
Houston, Texas 77208-1389
Telephone: (713) 221-3301
Facsimile (713) 221-3287

1753467.1